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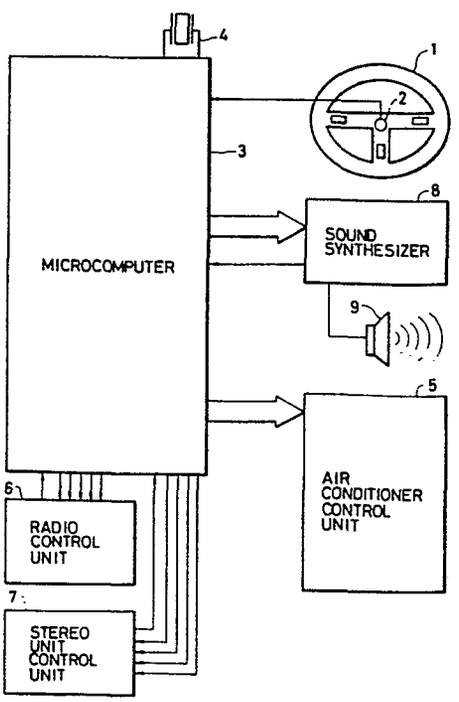
(54) Method and apparatus for controlling vehicle mounted devices and equipment.

(57) A demand for a change in the operating condition of at least one of a plurality of vehicle mounted devices is issued by means of a single push button switch (2) attached to the center of the steering wheel (1). When the vehicle occupant intends to manipulate a device such as a radio, stereo unit or an air conditioner, he depresses the switch to supply a microcomputer with a demand signal. The microcomputer (3) produces an instruction signal with which a sound synthesizer (8) produces sequential vocal annoucements which are emitted via a speaker (9). The occupant depresses the switch again within a predetermined period of time after the emission of a vocal announcement naming a device intended to control so that the sound synthesizer now provides various manipulative information relating to the available manipulations of the selected device. The driver depresses the switch to issue responsive instructions in response to an announcement of desired manipulation. The microcomputer thus operates to produce necessary control signals which are fed to a corresponding control unit (5, 6, 7) of the selected device. A sound recognizer (11) may be used in place of or together with the switch (2) to detect the demand and responsive instruction from the driver.

FIG. 1



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TITLE OF THE INVENTION

METHOD AND APPARATUS FOR CONTROLLING VEHICLE MOUNTED DEVICES AND EQUIPMENT

BACKGROUND OF THE INVENTION

This invention relates generally to method and apparatus for controlling various devices and equipment mounted on a vehicle, such as an automobile, and more particularly, the present invention relates to control of vehicle mounted devices whose operating conditions can be changed as desired.

Conventionally, changes of operating conditions of various devices and equipment in an automobile, for instance, a radio receiver, a stereo unit, an air conditioner or the like, have been effected manually by the occupant of the automobile. Namely, when the driver or the passenger of the motor vehicle intends to listen to a radio, he manually turns on the switch of the radio, and then he tunes the radio to a desired broadcasting frequency. Furthermore, he may manipulate the sound volume adjusting knob of the radio to set the sound volume to a desired level. In the same manner, when it is intended to operate a stereo unit or an air conditioning system of the motor vehicle, the occupant manipulates a corresponding switch or key to turn on a desired device, and then necessary adjustment, such as adjustment of temperature or the operating mode, is manually

effected.

However, the manual operation of such switches, keys or the like tends to distract the vehicle driver from steering efforts to such an extent that it might lead to a dangerous situation. Therefore, there have been a problem that manipulation for changing the operating condition of the vehicle mounted devices cannot be effected readily when the motor vehicle is running. The main reason for the difficulty of manipulation of the switches or the like of such devices resides in the fact that the positions of the manipulative switches or the like cannot be accurately recognized by the driver since his attention is mainly paid to the front of the motor vehicle.

SUMMARY OF THE INVENTION

The present invention has been developed in order to provide a method and apparatus for controlling various devices and equipment mounted on a vehicle so that the vehicle driver is not bothered by manipulation of various switches, knobs or the like.

It is, therefore, an object of the present invention to provide a method and apparatus for automatically controlling various devices mounted on a vehicle with simple instructions from the occupant so that safe driving is ensured.

According to a feature of the present invention,

sequential vocal announcements are emitted from a vehicle mounted speaker so that the vehicle occupant can selectively respond to a desired announcement. The announcements include various names of the devices to be operated and names of operations or manipulations to be performed. The occupant issues responsive instructions against an announcement when he wishes the named device to operate. The responsive instruction may be given either by manipulating a single switch or button or by pronouncing predetermined vocal sounds. In the case that the responsive instructions are given by vocal sounds, a sound recognizer responds to the vocal sounds to detect the contents thereof. Various operating conditions, such as tuning of a radio, sound volume control of the radio or a stereo unit, temperature control and operating mode control of an air conditioner, may be effected by supplying the vehicle occupant with corresponding information and by receiving responsive instructions from the occupant in the same manner.

Although the emobodiments of the present invention will be described in connection with the control of vehicle mounted devices, the invention may be adapted to control devices in a factory, plant or the like so that a number of manipulations of various devices can be simply controlled with a single switch or by talking to a vocal sound responsive unit.

In accordance with the present invention there is provided a method of controlling devices each having at least one manipulative element, comprising the steps of: detecting an action of an operator indicating that a demand has occurred for a change in operating conditions of at least one of said devices which are arranged to operate under the control of predetermined instructions; emitting sequential vocal announcements each corresponding to the manipulations of manipulative elements of said devices in response to the detection of said action, each of said vocal announcements being emitted at an interval to allow the operator to issue responsive instructions; monitoring said responsive instructions from the operator for a predetermined period of time after the emission of each announcement; and changing the operating conditions of one of said devices by automatically operating one of said manipulative element which has been announced just before the receipt of said responsive instructions.

In accordance with the present invention there is also provided apparatus for controlling devices each having at least one manipulative element, comprising: control means for effecting manipulative control of each of said devices in accordance with manipulative instruction signals; means responsive to the action of an operator for receiving a demand for a change in operating conditions of at least one

of said devices; vocal announcements emitting means for emitting sequential vocal sounds indicative of the names of said devices in response to the detection of said action, said vocal announcements being emitted at an interval to allow the operator to issue responsive instructions, said vocal announcements emitting means being capable of emitting sequential vocal sounds indicating the names of manipulative elements of each of said devices ; means responsive to said responsive instructions from the operator for a predetermined period of time after the emission of each announcement for controlling said vocal announcement emitting means so that said vocal announcements indicating the names of said manipulative elements of one of said devices are emitted in a sequence when said responsive instructions are received within said predetermined period of time after the emission of each announcement indicative of one of said devices; and means for producing said manipulative instruction signals to cause said control means to effect a desired manipulation of said manipulative elements which has been announced just before the receipt of said responsive instructions which are received within said predetermined period of time.

BRIEF DESCRIPTION OF THE DRAWINGS

The object and features of the present invention will become more readily apparent from the following detailed description of the preferred embodiments taken in conjunction with the accompanying drawings in which:

Fig. 1 is a schematic diagram showing the entire entire structure of an embodiment of the present invention;

Fig. 2 is an operational flow chart showing the operational processing in the entire microcomputer of Fig. 1;

Fig. 3 is an operational flow chart showing a detailed operational processing in the manipulative control routine of Fig. 2;

Fig. 4 is an operational flow chart showing a detailed operational processing of the instruction execution routine of Fig. 3;

Fig. 5 is an operational flow chart showing a detailed operational processing of the power instruction routine of Fig. 4;

Fig. 6 is an operational flow chart showing a detailed operational processing of the sound volume adjustment routine of Fig. 4;

Fig. 7 is an operational flow chart showing a detailed operational processing of the temperature control instruction routine of Fig. 4;

Fig. 8 is an operational flow chart showing a detailed operational processing of the airflow rate control instruction routine of Fig. 4;

Fig. 9 is an operational flow chart showing a detailed operational processing of the air outlet switching routine of Fig. 4; and

Fig. 10 is a partial structural view of another embodiment.

The same or corresponding elements and parts are designated at like numerals throughout the drawings.

DETAILED DESCRIPTION OF THE INVENTION

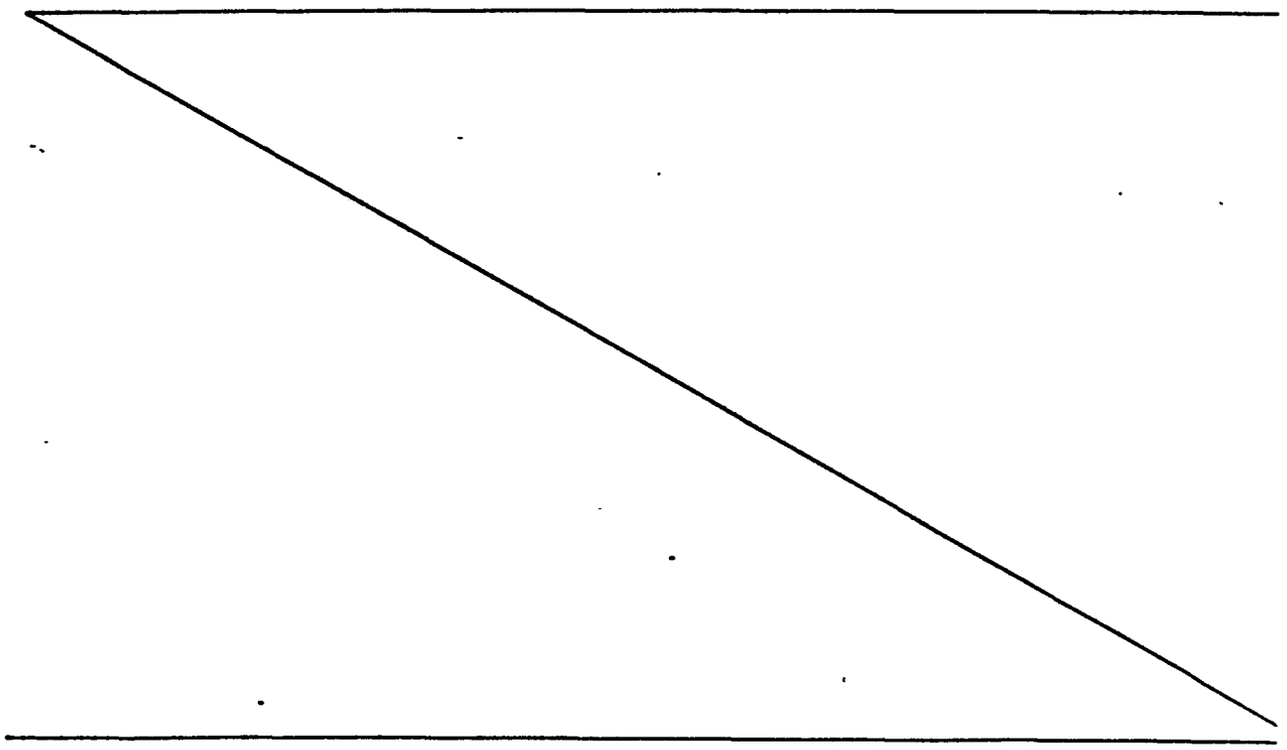
Referring now to Fig. 1, a schematic diagram of an embodiment of the present invention is shown. The apparatus of Fig. 1, which is also used to perform the method according to the present invention, generally comprises a normally-open push button switch 2 attached to the center of the steering wheel 1 of an unshown motor vehicle, a microcomputer 3, a sound synthesizer 8 which supplies a vehicle mounted speaker 9 with synthesized vocal sounds.

The microcomputer 3 is responsive to a signal from the push button switch 2, which will be referred to as a manipultive switch hereafter. The manipulative switch 2 is provided for receiving a demand or instructions from an operator, such as the driver of the motor vehicle. A crystal resonator 4 is shown to be connected to the microcomputer 3 having unshown central processing unit (CPU), a read-only memory (ROM). a random access memory (RAM), a clock generator, and input/output (I/O) devices. Namely the structure of the microcomputer is of convetional so that it operates in accordance with a predetermined program stored in the ROM in a well known manner. The microcomputer 3 has

output terminals connected to the sound synthesizer 8 and to various control units. In the illustrated embodiment, an air conditioner control unit 5, a radio control unit 6 and a stereo unit control unit 7 are shown to be connected to the outputs of the microcomputer 3. The microcomputer 3 also comprises input terminals for receiving signals indicative of the operating state of the radio and the stereo unit.

Although no power source is shown, the microcomputer 3 is arranged to receive a stabilized voltage via a voltage regulating circuit from the vehicle mounted battery.

In the above-mentioned ROM, are included regions M(0) to M(39) for storing instruction steps shown in the following table.



1	M(0)	INST FOR SOUND "RADIO"	M(20)	SET TEMP CONTROL FLAG
2	M(1)	SET RADIO FLAG		INST FOR SOUND "UP"
3		INST FOR SOUND "TUNING"	M(21)	SET UP FLAG
4	M(2)	SET TUNING FLAG	M(22)	INST FOR SOUND "DOWN"
5	M(3)	INST FOR SOUND "POWER"	M(23)	SET DOWN FLAG
6	M(4)	SET POWER FLAG	M(24)	INST FOR SOUND "AIRFLOW RATE"
7	M(5)	INST FOR SOUND "SOUND VOLUME"	M(25)	SET AIRFLOW RATE FLAG
8	M(6)	SET SOUND VOLUME FLAG		INST FOR SOUND "UP"
9		INST FOR SOUND "UP"	M(26)	SET UP FLAG
10	M(7)	SET UP FLAG	M(27)	INST FOR SOUND "DOWN"
11	M(8)	INST FOR SOUND "DOWN"	M(28)	SET DOWN FLAG
12	M(9)	SET DOWN FLAG	M(29)	INST FOR SOUND "OUTLET"
13	M(10)	INST FOR SOUND "STEREO UNIT"	M(30)	SET OUTLET FLAG
14	M(11)	SET STEREO UNIT FLAG		INST FOR SOUND "VENTILATION"
15		INST FOR SOUND "POWER"	M(31)	SET VENTILATION FLAG
16	M(12)	SET POWER FLAG	M(32)	INST FOR SOUND "HEATER"
17	M(13)	INST FOR SOUND "SOUND VOLUME"	M(33)	SET HEATER FLAG
18	M(14)	SET SOUND VOLUME FLAG	M(34)	INST FOR SOUND "BILEVEL"
19		INST FOR SOUND "UP"	M(35)	SET BILEVEL FLAG
20	M(15)	SET UP FLAG	M(36)	INST FOR SOUND "DEFROSTER"
21	M(16)	INST FOR SOUND "DOWN"	M(37)	SET DEFROSTER FLAG
22	M(17)	SET DOWN FLAG	M(38)	INST FOR SOUND "AUTOMATIC"
23	M(18)	INST FOR SOUND "AIR CONDITIONER"	M(39)	SET AUTOMATIC FLAG
24	M(19)	SET AIR CONDITIONER FLAG		
25		INST FOR SOUND "TEMPERATURE"		

INST: INSTRUCTION

The air conditioner control unit 5 comprises therein an opening degree adjusting actuator for controlling the air mixing damper used for temperature adjustment, a motor drive circuit for driving the blower motor used for sending temperature-adjusted air to the automobile compartment, outlet switching actuator for changing the various operational modes of the temperature-adjusted air outlets. These devices are respectively controlled by various instruction signals from the microcomputer 3 so as to adjust the air in the automobile compartment.

The radio control unit 6 has a function of turning on and off the power source of the radio in response to a power source on-off instruction signal from the microcompute 3, a function of adjusting the sound volume in response to a sound volume instruction signal from the microcomputer 3, and a function of automatically tuning in response to a tuning instruction signal from the microcomuter 3. The radio control unit 6 is arranged to send a signal indicative of on or off state of the power source of the radio to the microcomputer 3.

The stereo unit control unit 7 has a function of turning on and off the power source of the stereo unit in response to a power souce on-off instruction signal from the microcomputer 3, and a function of adjusting the sound volume in response to a sound volume instruction signal from the

microcomputer 3. The stereo unit control unit 7 is arranged to send a signal indicative of on or off state of the power source of the stereo unit to the microcomputer 3.

The sound synthesizer 8 comprises a vocal sound data ROM for storing vocal sound data, which is used for emitting vocal sounds, in each predetermined region thereof. The sound synthesizer 8 is arranged to synthesize the contents of a predetermined region of the sound data ROM from the first address thereof in response to an instruction signal fed from the microcomputer 3, namely, in response to an address designation signal designating the first address of the predetermined region, to emit the synthesized vocal sound from the speaker 9, and is further arranged to send a vocal sound termination signal indicating the termination of sound synthesizing to the microcomputer 3 when reaching the last address of the predetermined region.

The operation of the apparatus of Fig. 1 will be described with reference to operational flow charts of Figs. 2 to 9. Fig. 2 is an operational flow chart showing the entire operation of the microcomputer 3; Fig. 3, an operational flow chart showing detailed operation of the manipulative control operation routine in Fig. 2; Fig. 4, an operational flow chart showing detailed operation of instruction execution routine in Fig. 3; and Figs. 5 to 9, operational flow charts showing detailed operations of

respective instruction routines in Fig. 4.

When an unshown key switch is turned on in an automobile comprising the elements or devices 1 to 9 shown in Fig. 1 at the time of starting operation, electric power is supplied from the automobile battery to respective electrical systems to render the same active. The microcomputer 3 starts operating from the starting step 100 of Fig. 2 to set the registers, counters and latches in the microcomputer 3 to their initial conditions which are necessary for starting operation. The operation of setting to initial conditions includes a step of resetting all flags, which will be described later, and a step of setting initial values for airflow mode data, blow off mode data and so on. Operation of the main routine, which will be described hereinbelow, comprising an air conditioner control routine 300 and a manipulative control routine 400 is repeatedly executed at an interval of several hundreds of milliseconds.

In the air conditioner control routine 300, various instruction signals are sent to the opening degree ajdustor, the motor drive circuit, and to the outlet switching atuator of the air conditioner control unit 5 by executing operational processing for pertinently controlling the air in the automobile compartment, namely by calculating the opening degree of the air mixing damper and the airflow rate data W etc. on the basis of detection signals from various sensors

and temperature setting data T preset in a temperature setting circuit and airflow rate and blow off mode data based on mode information preset in an airflow rate and blow off mode setting circuit. The sensors for measuring inner and outer temperatures and for detecting air mixing damper opening degree, and the temperature setting circuit as well as the airflow and blow off mode setting circuits are not shown in Fig. 1 for simplicity. As a result of the operation, instruction signals are fed to the opening degree adjustment actuator of the air conditioner control unit 5, the motor drive circuit and the outlet switching actuator.

In a following manipulative control operation routine 400, the turn-on signal from the manipulative switch 2 is monitored, which turn-on signal indicates that a deman has occurred for a change in operating conditions of at least one of the devices 5, 6 and 7. When detecting the turn-on signal during monitoring, the names of various manipulations of the radio, stereo unit and the air conditioner are announced in a predetermined sequence. When another turn-on signal from the manipulative switch 2 is detected, an operation is executed so that an instruction signal is fed to an objective control unit, with which instruction signal of the announced manipulation at the last will be performed.

Fig. 3 shows a detailed operational flow of the manipulative control routine 400. When reaching the

manipulative control routine 400, if the manipulative switch 2 has never been turned on till this time, the answer of a starting flag deciding step 401, which comes first, assumes NO because all the flags used in the manipulative control routine 400 have been reset. Then the operational flow enters into a manipulative switch state deciding step 402, where the answer thereof assumes NO when the manipulative switch 2 has not been turned on, to terminate one cycle of the operation of the manipulative control routine 400. Ater this. the above-operation is executed whenever reaching the manipulative control operation routine 400 as long as the manipulative switch 2 is not turned on.

After this, when the manipulative switch 2 is turned on to change the power of the radio from OFF state to ON state, the level of the signal from the manipulative switch 2 varies to cause the answer of the manipulative switch state deciding step 402 of Fig. 3 to become YES. Then the operational flow goes to the starting flag setting step 403 to set the starting flag. Then entering into a designation region setting step 404 to set a designation region M to M(0), and the operational flow goes to an execution step 405 to execute the contents of the region M(0) of the ROM of the microcomputer 3. Namely, an instruction signal for announcing "RADIO" according to the ROM table is sent to the sound synthesizer 8, and the operational flow enters into an

instruction execution routine 500. With this operation, the sound synthesizer 8 starts synthesing the vocal sound of "RADIO".

In the instruction execution routine 500, since all the radio flag, stereo unit flag and the air conditioner flag are left in reset condition, which was done in the initial setting, all the answers of the radio flag deciding step 501, the stereo unit flag deciding step 502 and the air conditioner flag deciding step 503 assume NO to terminate one cycle of the operation.

When the operational flow reaches again the starting flag deciding step 401 of the manipulative control routine 400 of Fig. 3, the answer thereof becomes YES since the starting flag has been set. Because a continuation flag and a timer flag have been reset from the initial setting, the following continuation flag deciding step 418 and the timer flag deciding step 406 assume NO, and the operational flow enters into a vocal sound termination deciding step 407 where the answer thereof assumes NO because no vocal sound termination signal has been sent from the sound synthesizer 8. The operational flow enters into a manipulative switch state deciding step 408 whose answer assumes NO when the manipulative switch has not been turned on again. Thus, the operational flow enters into the instruction execution routine 500 to execute the above-described operation.

In the case that the vocal sound termination signal is not sent from the sound synthesizer 8 while the manipulative switch 2 is not turned on again, the above operation is repeatedly executed. When the sound synthesizer 8 completes synthesizing the vocal sound of "RADIO" and produces the vocal sound termination signal, the answer of the vocal sound termination deciding step 407 becomes YES when the operational flow reaches it. Then the operational flow enters into a timer flag setting step 409 to set the timer flag, and then goes to a time measuring step 410 to measure the time counting the number of times of reaching. As two seconds have not elapsed since entering into the time measuring step 410, the answer thereof assumes NO to go to the manipulation switch state deciding step 408. Accordingly, whenever the operational flow reaches the timer flag deciding step 406 from the next time, the operational flow directly goes to the time measuring step 410 because the timer flag has been set to cause the answer of decision thereof to become YES. Namely, it is made possible to accept responsive instructions via the manipulative switch 2 for the operation of the radio until two senconds will have passed from the emission of the vocal announcement of "RADIO".

When it is recognized by the operator, such as the vehicel driver, that the radio should be manipulated and the manipulative switch 2 is turned on before the lapse of two

senconds, the answer of the manipulation switch deciding step 408 becoms YES as the operational flow reaches it to enter into a first designation region changing step 412. In the first designation region changing step 412, the designation regions are changed by one in connection with the designation region M according to the arrows shown below.

M(0)->M(1)->M(2), M(3)->M(4), M(5)->M(6) M(7), M(8)->M(9), M8(10)->M(11)->M(12), M(13)->M(14)->M(15), M(16)->M(17), M(18)->M(19)->M(20)->M(21), M(22)->M(23), M(24)->M(25)->M(26), M(27)->M(28), M8(29)->M(30)->M(31), M(32)->M(33), M(34)->M(35), M(36)->M(37), M(38)->M(39)

Since the designation region M by that time has been M(0), the designation region M becomes M(1) after being changed. The operational flow enters into a next execution step 415 to execute the contents of M(1), where the radio flag is set according to the above-mentioned ROM table, and an instruction signal for announcing "TUNING" is sent to the sound synthesizer 8, while the timer flag is set. Then the operational flow goes to the timer flag setting step, and then goes to the instruction execution routine 500. With this operation, the sound synthesizer 8 starts synthesizing vocal sounds of "TUNING". When the operational flow reaches a radio flag deciding step 501 of the instruction execution routine 500, the answer thereof becomes YES to go to a tuning

flag deciding step 504, power flag deciding step 505 and to a sound volume flag deciding step 506. Since all these flags have been reset from the initial setting, all the answers thereof assume NO to complete one cycle of operation.

When the operational flow reaches the timer flag deciding step 406 of Fig. 3, the answer thereof becomes NO because ot the reset state of the timer flag, and thus the operational flow changes to enter into the instruction execution routine 500 via the vocal sound termination deciding step 407 and the manipulative switch state deciding step 408. When the sound synthesizer 8 completes synthesizing the vocal sound of "TUNING" and produces a sound termination signal, the operational flow goes from the vocal sound termination deciding step 407 to the timer flag setting step 409 to set the timer flag, and thus, the answer of the timer flag deciding step will be YES from the next time when the operational flow reaches it, and the operational flow goes via the time measuring step 410, time deciding step 411 and the manipulative switch deciding step 408 to the instruction execution routine 500.

When a period of time of two seconds passes without receiving the turn-on signal from the manipualative switch 2 with the operator's recognition that the emitted vocal sound of "TUNING" is different from one which is intended to manipulate, the answer of the time deciding step 411 becomes

YES when the operational flow reaches it, and thus the operational flow goes to a termination deciding step 413. In the termination deciding step 413, it is decided whether or not the designation region M corresponds to one of M(5), M(8), M(13), M(16), M(18), M(22), M(27), M(29), M(38). Thus, the answer of the decision becomes NO because the designation region M by that time is M(1), and therefore, the operational flow goes to a second designation region changing step 414. In the second designation region changing step 414, the designation region M is changed by one in accordance with the following arrows.

M(0)→M(10)→M(18), M(1)→M(3)→M(5), M(6)→M(8), M(11)→M8(13), M(14)→M(16), M(19)→M(24)→M(29), M(20)→M(22), M(25)→M(27), M(30)→M(32)→M(34)→M(36)→M(38)

Since the designation region M has been M(1) by that time, the designation region M will be M(3) after being changed. Then the opeational flow goes to a next execution step 415 in which the contents of M(3) are executed, namely, an instruction signal for announcing "POWER" is sent according to the ROM table to the sound synthesizer 8, and the operational flow goes to the instruction execution routine 500 via a timer flag resetting step 416. With this operation the sound synthesizer 8 starts synthesizing the vocal sound of "POWER" to announce the same.

In the same manner as described in the above, it is monitored, in connection with the announcement of "POWER", to detect if the manipulative switch 2 is turned on until two senconds elapse. When the manipulative switch 2 is turned on with the operator's recognition that the power source should be turned on in response to the vocal sound emission, the answer of the manipulative switch state deciding step 408 becomes YES when the operational flow reaches it, and thus the operational flow goes to the first designation region changing step 412. Since the designation region M has been M(3) by that time, the designation region becomes M(4) after being changed according to the above-described changes. Then in the next executing step 415, the contents of M(4) of the ROM table, namely, the power flag is set. Accordingly, in the instruction execution routine 500 following the timer flag resetting step 416, when the operational flow reaches the power flag deciding step 505 of Fig. 4, the answer thereof becomes YES to go to a power instruction routine 513. In the power instruction routine 513, an instruction signal for the operational processing shown in Fig. 5, i.e. an instruction signal for changing the power condition in accordance with the power on-off state signal from the radio control unit 5, is sent to the radio control unit 5. Entering into an all-flag resetting step 520 of Fig. 4, all the flags necessary for operating processing in the

manipulative control routine 400 to complete one cycle of the operation. Therefore, when the operational flow reaches the starting flag deciding step 401 of Fig. 3 next time, which step is encountered first in the manipulative control routine 400, the answer thereof becomes NO to assume the same condition as in the initial condition described in the above. The radio control unit 5 puts the radio power source in ON state in response to the power-on instruction signal.

In the case that the manipulative switch 2 is turned on to tune the radio, and then the manipulative switch 2 is again turned on when the vocal sound of "TUNING" is emitted, tuning flag is set because the designation region M is changed to M(2) in the first designatin region changing step 412. Consequently, when the operational flow reaches the tuning flag deciding step 504, the answer thereof becomes YES to go to the tuning instruction step 512 in which a tuning instruction is sent to the radio control unit 5. With this operation, the radio control unit 5 causes the radio to be tuned.

Suppose the manipulative switch 2 is turned on to adjust the sound volume of the radio so that the designation region M is changed from M(3) to M(5) in the second designation region changing step 415 after vocal sounds of "RADIO", "TUNING" and "POWER" are emitted. If the manipulative switch 2 is again turned on when the vocal sound

of "SOUND VOLUME" is emitted, the designation region M is changed from M(5) to M(6) in the first designation region changing step 412. Then a sound volume flag is set in the execution step 415 while an intruction for vocal sound of "UP" is sent to the sound synthesizer 8. Therefore, when the operational flow reaches a sound volume flag deciding step 506 of Fig. 4, the answer thereof becomes YES to go to a sound volume adjustment instruction routine 514 in which operational processing shown in Fig. 6 is executed, and no sound volume instruction does not occur since none of up flag and down flag has been set. When the manipulative switch 2 is continously depressed to be turned on in response to the emission ot the sound of "UP", the up flag will be set because the designation region M is changed to M(7) in the first designation region changing step 412. With this operation, the continuation flag is set and simultaneously, an instruction signal, with which increase by 3dB per one second will result, is sent to the radio control unit 5 in the sound volume adjustment instruction routine 514 of Fig. 6. As a result, the sound volume of the radio increases more and more. The increase in sound volume stops by cancelling the turn-on state of the manipulative switch 2, and all the flags necessary for operational processing in the manipulative control routine 400 are reset. In order to decrease the sound volume, the manipulative switch 2 may be

continously turned on in response to the vocal sound of "DOWN" which is emitted after "UP", so that decrease by 3dB per one second will result in the same manner as described in the above.

Namely, it is possible to emit various vocal sounds in a predetermined sequence in accordance with the contents of the above-mentioned ROM table, the first designation region changing step 412 and the second designation region changing step 414, while changes in operation in various manipulating elements can be efected by turning on the manipulative switch 2 at an appropriate time.

For instance, in the case of operating the stereo unit, the manipulative switch 2 is not turned on in response to the emission of the vocal sound of "RADIO", but is turned on in response to the sound of "STEREO UNIT" which is emitted subsequently. Thus, the stereo unit flag is set so that the answer of the stereo unit flag deciding step 502 of Fig. 4 becomes YES. When the manipulative switch 2 is turned on in response to the sound of "POWER" emitted after this, the power flag is set so that the answer of the power flag deciding step 507 becomes YES when the operational flow reaches it, and the operational flow goes to a power instruction step 515 to produce power on/off instruction signal (this is done by the same operating process as in Fig. 5) to turn on or off the stereo unit. When it is intended to

adjust the sound volume rather than the on/off operation of power, the manipulative switch 2 is not manipulated at all in response to the emission of the vocal sound of "POWER", but the manipulative switch 2 is again turned on in response to the sound of "SOUND VOLUME" which is emitted subsequently, the sound volume flag is set to cause the answer of the sound volume flag deciding step 508 to assume YES when the operational flow reaches it. The operational flow goes to a sound volume adjustment instruction routine 516 and the same operating processing as in Fig. 6, namely an operating processing for sending an instruction signal with which increase or decrease by 3dB per one second is effected when the manipulative switch is continously turned on in response to "UP" or "DOWN" to the stereo unit control unit 6, is executed.

On the other hand, in the case of operating the air conditioner, the manipulative switch 2 is not turned on in response to the emission of sounds of "RADIO" and "STEREO UNIT", but is turned on in response to emission of vocal sound "AIR CONDITIONER" which is emitted subseqently, and thus the air conditioner flag is set so that the answer of the air conditioner flag deciding step 503 of Fig. 4 becomes YES. When the manipulative switch 2 is turned on in response to the vocal sound of "TEMPERATURE" which is emitted subsequently, temperature control flag is set so that the

answer of the temperature control flag deciding step 509 becomes YES when the operational flow reaches it. Thus, the operational flow goes to a temperature control instruction routine 517 in which the operating processing of Fig. 7 is executed in the same manner as in the case of sound volume adjustment shown in Fig. 6. Namely, when the manipulative switch 2 is continuously depressed to be turned on in response to the emission of the sound of "UP" or "DOWN", the predetermined temperature data T is either raised or lowered by 1 degree centigrade per two seconds, and an instruction signal for emitting the vocal sound of the value of the changed, i.e. raised or lowered, temperature is sent to the sound synthesizer 8. Accordingly, air conditioning is effected so that the temperture in the automobile compartment approaches the changed temperature setting by executing the air conditioner control routine 300 with respect to the changed temperature setting data T.

In the case of adjusting the airflow rate rather than the temperature adjustment, the manipulative switch 2 is not manipulated at all in response to "TEMPERATURE". The manipulative switch 2 is turned on in response to the announcement of "AIRFLOW" which is emitted subsequently, and thus an airflow flag is set to cause the answer of an airflow flag deciding step 510 to become YES when this step is encounterd. Then the operaional flow goes to an airflow

adjustment instruction routine 518 in which the operational processing shown in Fig. 8 is executed in the same manner as in the cases of Fig. 6 and Fig. 7. Namely, when the manipulative switch 2 is continuously turned on in response to the emission of the sound of "UP" or "DOWN", an operational process is executed to increase or decrease an airflow rate data W by ΔW per one second. Therefore, the airflow rate is either increased or decreased by executing the opertional process of the air conditioner control routine 300 of Fig. 2 with respect to the changed airflow rate data W.

In the case of changing the air outlets rather than the temperature adjustment and the airflow rate adjustment, the manipulative switch 2 is not manipulated at all in response to "TEMPERATURE" and "AIRFLOW", but is manipulated again in response to "OUTLETS" emitted subsequently so that outlet flag is set. Therefore, when the operational flow reaches an outlet flag deciding step 511, the answer thereof becomes YES to go to an outlet switching routine 519. If the manipulative switch 2 is not manipulated at all after reaching the outlet switching routine 519, vocal sounds of "VENTILATION", "HEATER", "BILEVEL", "DEFROSTER" and "AUTOMATIC" are emitted one after another. Thus, when the manipulative switch 2 is turned on in response to a vocal sound emission corresponding to an operating mode in which a ch

ange should be made, the corresponding flag is set so that an outlet mode data is changed in the operating process of Fig. 9. Accordingly, the outlets are switched in accordance with the changed mode by executing the air conditioner control routine 300 of Fig. 2 with respect to the corrected outlet mode.

On the other hand, when the operational flow reaches the termination deciding step 413 with the designation region M being M(5), M(8), M(13), M(16), M(18), M(22), M(27), M(29), M(38), while the manipulative switch 2 has not been turned on again in response to emission of vocal sound of a manipulative element to be changed or the like, namely, when two seconds have elapsed without receving the turn-on signal from the manipulative switch 2 after the emission of one of the vocal sounds of "SOUND VOLUME", "DOWN", "AIR CONDITIONER", "OUTLET" and "AUTOMATIC", the answer of the termination deciding step 413 becomes YES. Then the operational flow goes to the all-flag resetting step 417 to reset all the flags necessary for operational processing of the manipulative control routine 400, so that the operational processing for manipulative control returns to the above-mentioned initial condition.

In the above-described embodiment, although the manipulative switch 2, which is manually operable, is used to produce a demand or instruction signal, it may be possible to

receive the demand or instructions from the operator by recognizing the vocal sounds of "CHANGE", "YES" or "NO" of the driver or others by employing a sound recognizing circuit 11 with a microphone 10 provided in the vicinity of the steering wheel as shown in Fig. 10. The sound recognizer 11 detects a plurality of predetermined vocal words separately to send corresponding recognition signals to the microcomputer 3. Furthermore, both sound recognition and switch manipulation may used.

Although an example, in which the order of emission of sounds is predetermined, has been described, the order of vocal sound emission may be changed by providing a fast feeding switch or the like, or by arranging such that vocal sound emission takes immediately after the last vocal sound emission. Furthermore, it may be possible to arrange such that vocal sounds which are needed frequently are emitted preferentially.

Furthermore, the various manipulative elements to be controlled are not limited to those described in the above, and therefore, they may include wiper switch, head light switch or the like.

Furthermore, although the sound synthesizer 8 has been described as a vocal announcment emittin means, it is possible to use a device utilizing a magnetic recording tape or the like in which words to be pronounced have been prerecorded.

From the foregoing description, it will be understood that various devices mounted on a motor vehicle or the like can be readily and accurately controlled by issueing instructions by means of a manually operable switch or by pronouncing predetermined vocal words. Since there is no need to manipulate various switches or keys to turn on, to adjust or to select a desired operating mode of the device which is intended to operate, the vehicle driver can concentrate on driving the vehicle, and thus safe driving can be ensured.

The above-described embodiments are just examples of the present invention; and therefore, it will be apparent for those skilled in the art that many modifications and variations may be made without departing from the spirit of the present invention.

WHAT IS CLAIMED IS:

1. A method of controlling devices each having at least one manipulative element, comprising the steps of:

(a) detecting an action of an operator indicating that a demand has occurred for a change in operating conditions of at least one of said devices which are arranged to operate under the control of predetermined instructions;

(b) emitting sequential vocal announcements each corresponding to the manipulations of manipulative elements of said devices in response to the detection of said action, each ot said vocal announcements being emitted at an interval to allow the operator to issue responsive instructions;

(c) monitoring said responsive instructions from the operator for a predetermined period of time after the emission of each annòuncement; and

(d) changing the operating conditions of one of said devices by automatically operating one of said manipulative element which has been announced just before the receipt of said responsive instructions.

2. A method as claimed in Claim 1, wherein said step of detecting is performed by detecting a predetermined condition of a manually operable switch or by detecting a predetermined vocal demand from said operator.

3. A method as claimed in Claim 1, wherein said step of emiting vocal announcements comprises a step of synthesizing at least one predetermined vocal word by selectively reading the contents ot a memory in which data corresponding to various vocal words indicating said manipulations is stored.

4. A method as claimed in Claim 1, wherein said step of monitoring said responsive instructions is performed by detecting a predetermined condition of a manually operable switch or by detecting a predetermined vocal demand from said operator.

5. A method as claimed in Claim 1, wherein said step of emitting vocal announcements comprises a step of emitting a vocal sound only when no responsive instruction is detected within said predetermined period of time.

6. A method as claimed in Claim 3, further comprising a step ot changing a designation region with which predetermined contents of a predetermined region in said memory are read out, said step of changing the designation region being performed, when said responsive instructions are detected within said predetermined period of time, by changing said designation region by one to a next region in a sequence predetermined for each of said regions.

7. A method as claimed in Claim 6, further comprising another step of changing the designation region in a different manner from the first-mentioned changing step, said another step of changing being performed when said responsive instructions are not detected within said predetermined period of time, while the designation region assumes one of predetermined designation regions, said another step of changing the designation region being performed to change said designation region by one

8. A method as claimed in Claim 1, wherein said operating conditons to be controlled includes on/off operation, tuning and sound volume control of a radio mounted on a motor vehicle; on/off operation and sound volume control of a stereo unit mounted on said motor vehicle; and on/off operation, temperature adjustment, airflow rate control and air outlet switching of an air conditioning system mounted on said motor vehicle.

9. Apparatus for controlling devices each having at least one manipulative element, comprising:

(a) control means for effecting manipulative control of each of said devices in accordance with manipulative instruction signals;

(b) means responsive to the action of an operator for

receiving a demand for a change in operating conditions of at least one of said devices;

(c) vocal announcements emitting means for emitting sequential vocal sounds indicative of the names of said devices in response to the detection of said action, said vocal announcements being emitted at an interval to allow the operator to issue responsive instructions, said vocal announcements emitting means being capable of emitting sequential vocal sounds indicating the names of manipulative elements of each of said devices ;

(d) means responsive to said responsive instructions from the operator for a predetermined period of time after the emission of each announcement for controlling said vocal announcement emitting means so that said vocal announcements indicating the names of said manipulative elements of one of said devices are emitted in a sequence when said responsive instructions are received within said predetermined period of time after the emission of each announcement indicative of one of said devices; and

(e) means for producing said manipulative instruction signals to cause said control means to effect a desired manipulation of said manipulative elements which has been announced just before the receipt of said responsive instructions which are received within said predetermined period of time.

10. Apparatus as claimed in Claim 9, wherein said means responsive to the action comprises a manually operable switch; wherein said means responsive to the action comprises a sound recognizer which detects a predetermined vocal demand from said operator; wherein said vocal announcements emitting means comprises a sound synthesizer which produces vocal sounds by reading out contents of a predetermined region of a memory; wherein said means responsive to said responsive instructions comprises a sound recognizer which detects a predetermined vocal word from said operator.

FIG. 1

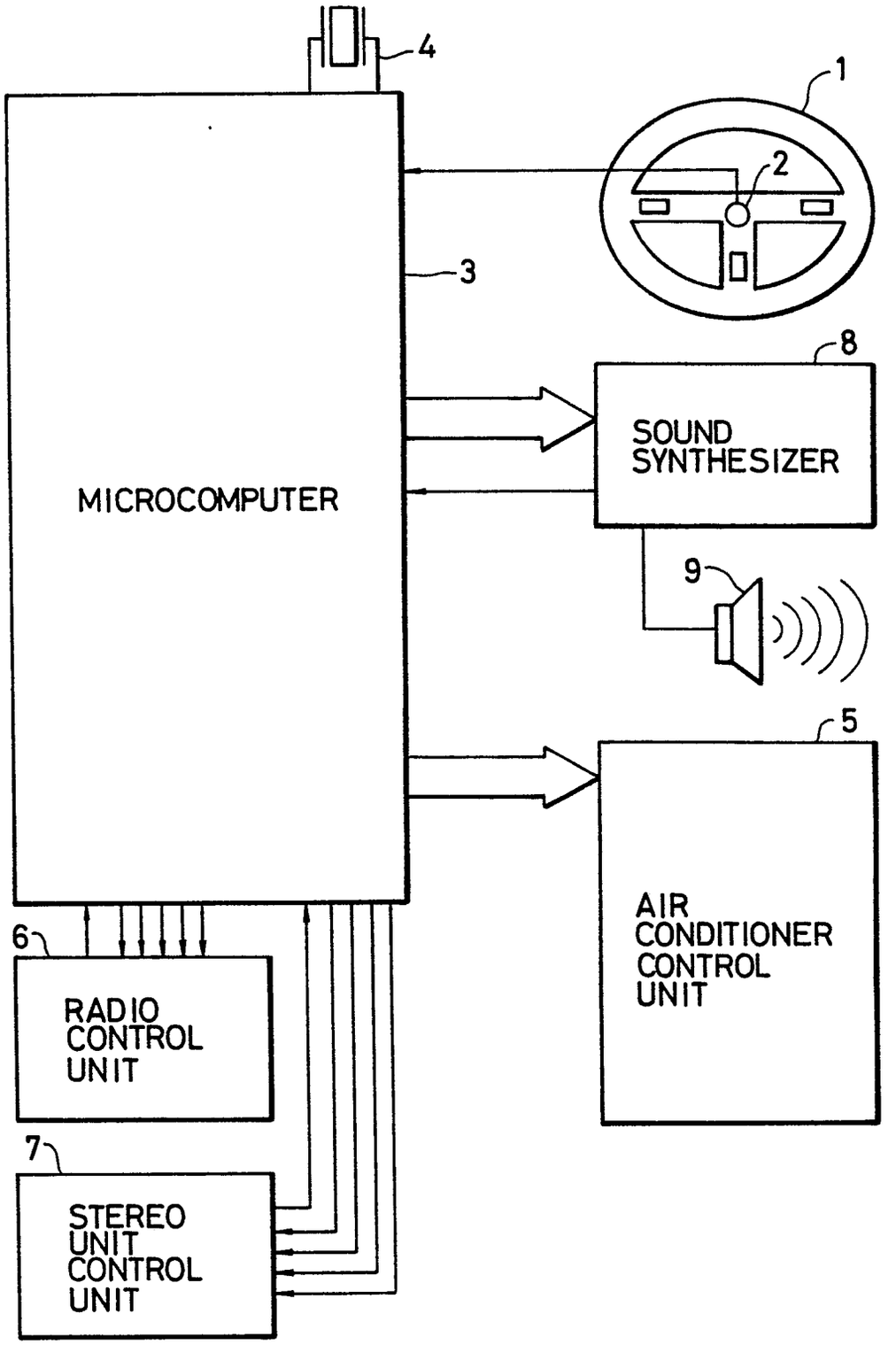

4
1
2
3
8
SOUND SYNTHESIZER
MICROCOMPUTER
9
5
AIR CONDITIONER CONTROL UNIT
6
RADIO CONTROL UNIT
7
STEREO UNIT CONTROL UNIT

FIG. 2

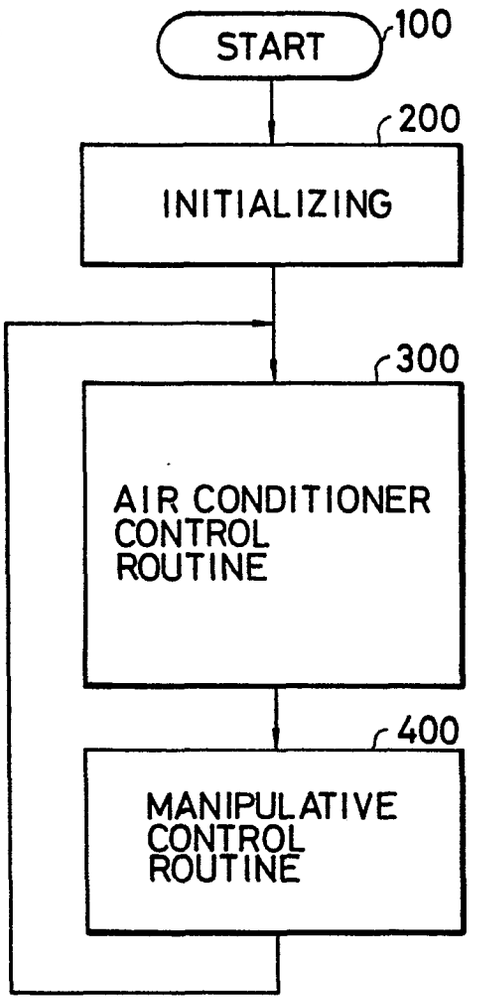

START
100
200
INITIALIZING
300
AIR CONDITIONER CONTROL ROUTINE
400
MANIPULATIVE CONTROL ROUTINE

FIG. 10

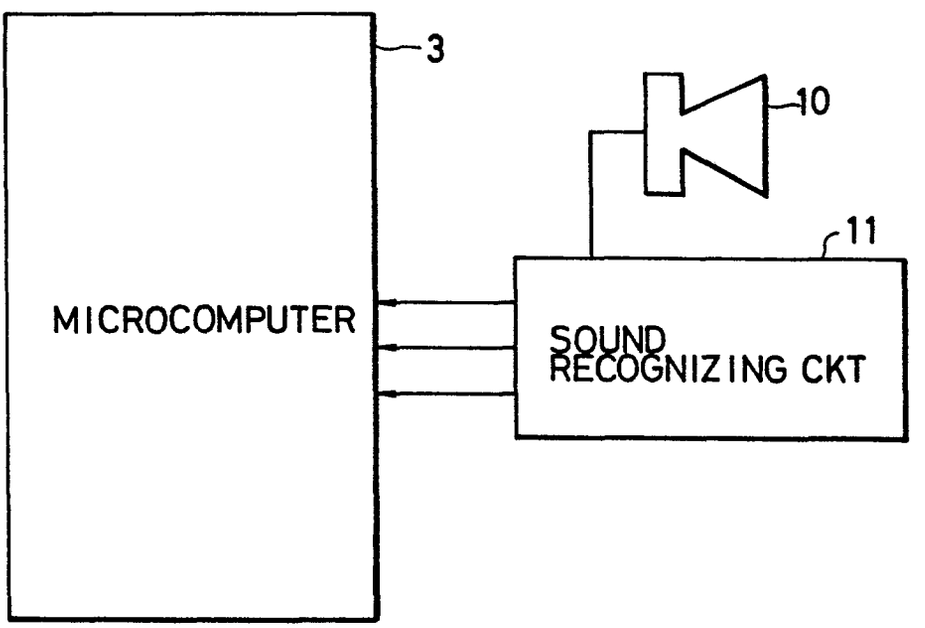

3
10
11
MICROCOMPUTER
SOUND RECOGNIZING CKT

FIG. 3

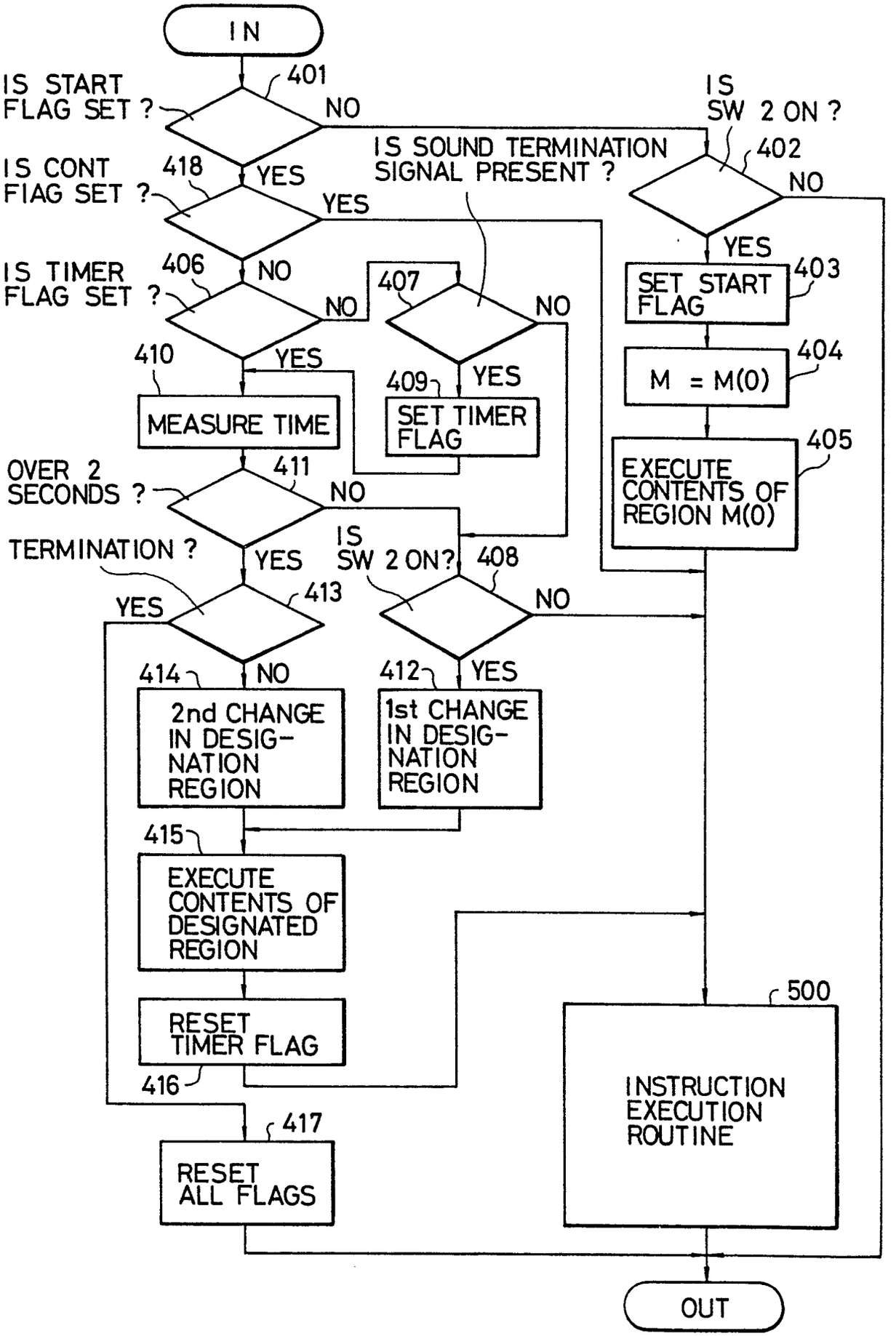

IN
401
IS START FLAG SET ?
NO
YES
IS SOUND TERMINATION SIGNAL PRESENT ?
IS SW 2 ON ?
402
NO
YES
418
IS CONT FIAG SET ?
YES
406
IS TIMER FLAG SET ?
NO
NO
407
NO
YES
SET START FLAG
403
410
YES
409
YES
M = M(0)
404
MEASURE TIME
SET TIMER FLAG
405
EXECUTE CONTENTS OF REGION M(0)
411
OVER 2 SECONDS ?
NO
TERMINATION ?
YES
IS SW 2 ON?
408
YES
413
NO
414
NO
412
YES
2nd CHANGE IN DESIG-NATION REGION
1st CHANGE IN DESIG-NATION REGION
415
EXECUTE CONTENTS OF DESIGNATED REGION
500
RESET TIMER FLAG
416
INSTRUCTION EXECUTION ROUTINE
417
RESET ALL FLAGS
OUT

FIG. 4

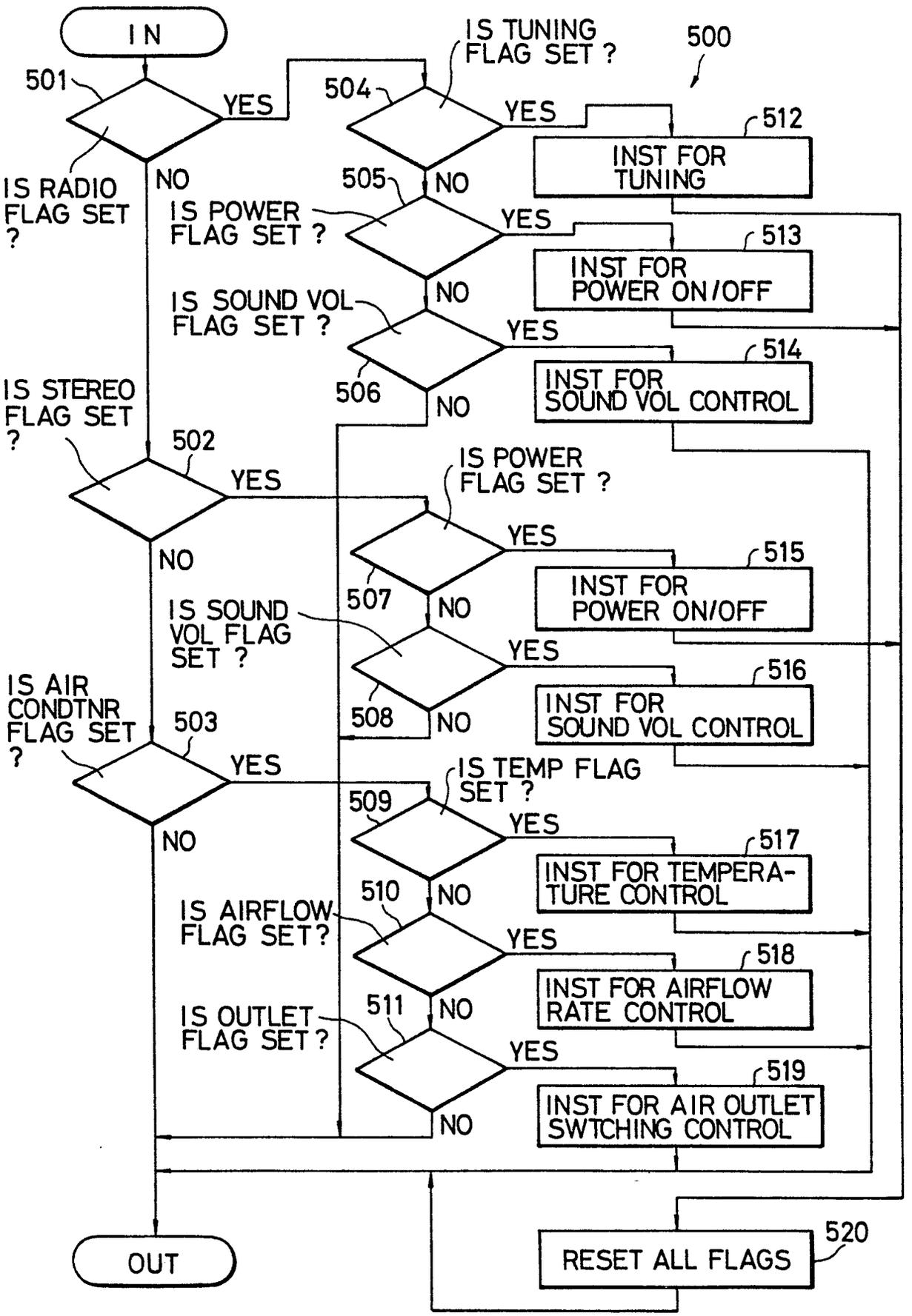

IN
501
IS RADIO FLAG SET ?
YES
NO
IS STEREO FLAG SET ?
502
YES
NO
IS AIR CONDTNR FLAG SET ?
503
YES
NO
OUT
IS TUNING FLAG SET ?
500
504
YES
512
INST FOR TUNING
NO
505
IS POWER FLAG SET ?
YES
513
INST FOR POWER ON/OFF
NO
IS SOUND VOL FLAG SET ?
YES
514
INST FOR SOUND VOL CONTROL
506
NO
IS POWER FLAG SET ?
YES
515
INST FOR POWER ON/OFF
507
NO
IS SOUND VOL FLAG SET ?
YES
516
INST FOR SOUND VOL CONTROL
508
NO
IS TEMP FLAG SET ?
509
YES
517
INST FOR TEMPERATURE CONTROL
NO
510
IS AIRFLOW FLAG SET?
YES
518
INST FOR AIRFLOW RATE CONTROL
NO
511
IS OUTLET FLAG SET ?
YES
519
INST FOR AIR OUTLET SWTCHING CONTROL
NO
RESET ALL FLAGS
520

FIG. 5

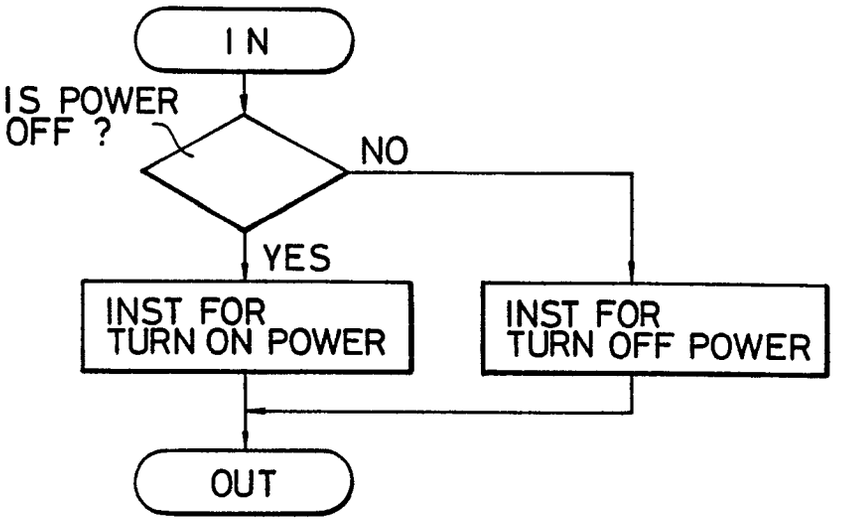

IN
IS POWER OFF ?
NO
YES
INST FOR TURN ON POWER
INST FOR TURN OFF POWER
OUT

FIG. 6

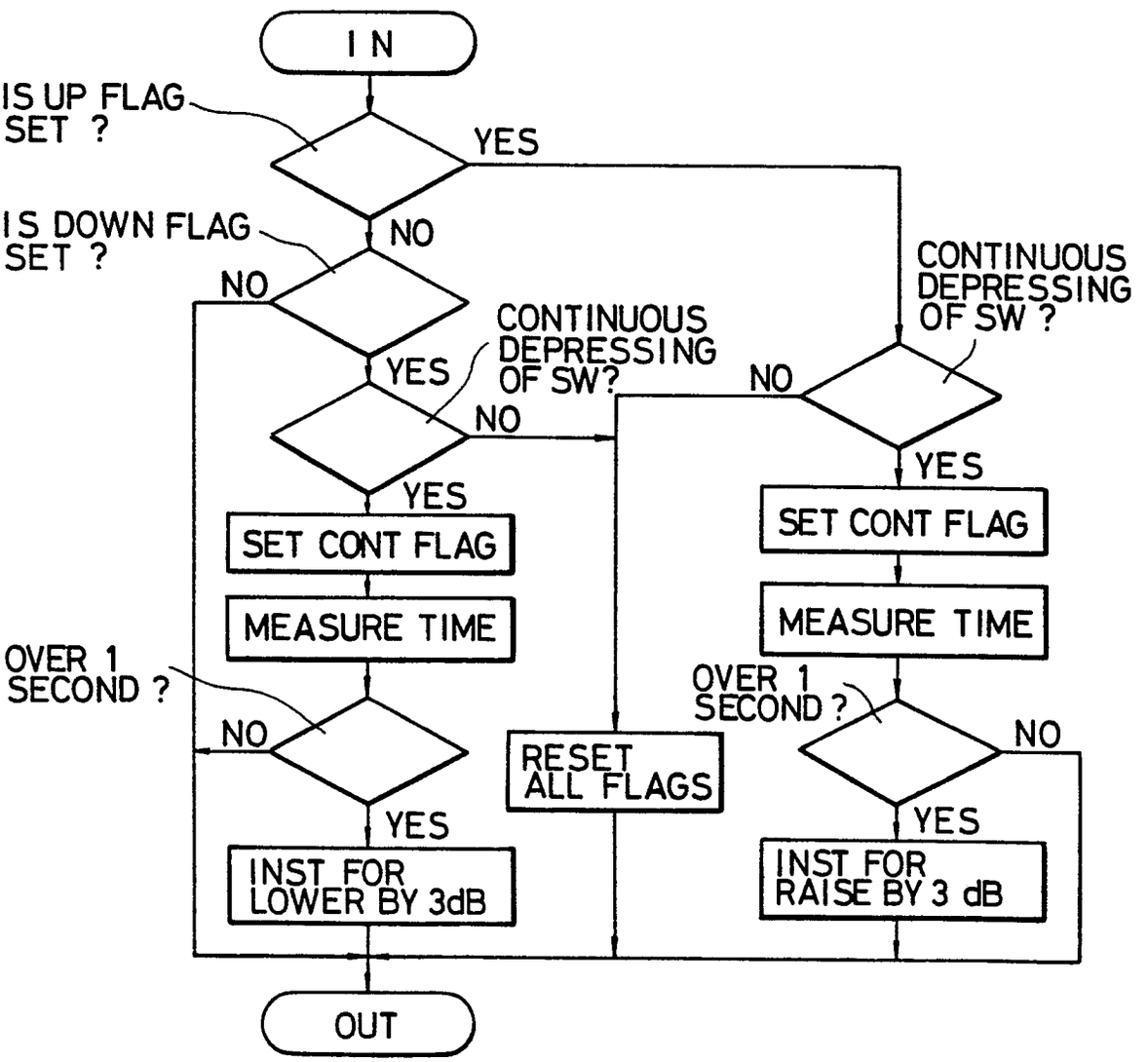

IN
IS UP FLAG SET ?
YES
IS DOWN FLAG SET ?
NO
NO
CONTINUOUS DEPRESSING OF SW?
YES
NO
CONTINUOUS DEPRESSING OF SW ?
NO
YES
YES
SET CONT FLAG
MEASURE TIME
SET CONT FLAG
MEASURE TIME
OVER 1 SECOND ?
NO
RESET ALL FLAGS
OVER 1 SECOND ?
NO
YES
YES
INST FOR LOWER BY 3dB
INST FOR RAISE BY 3 dB
OUT

FIG. 7

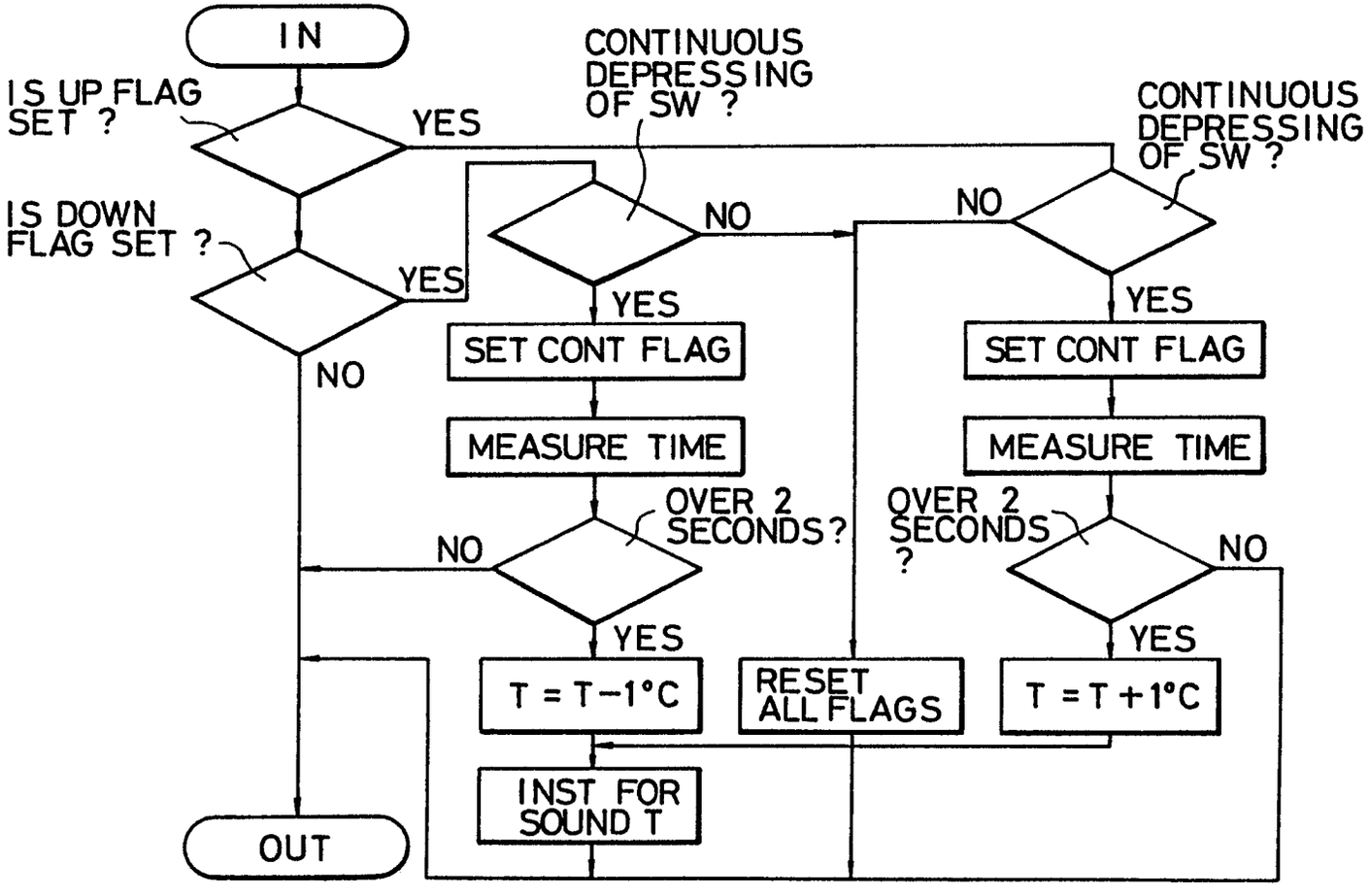


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FIG. 8

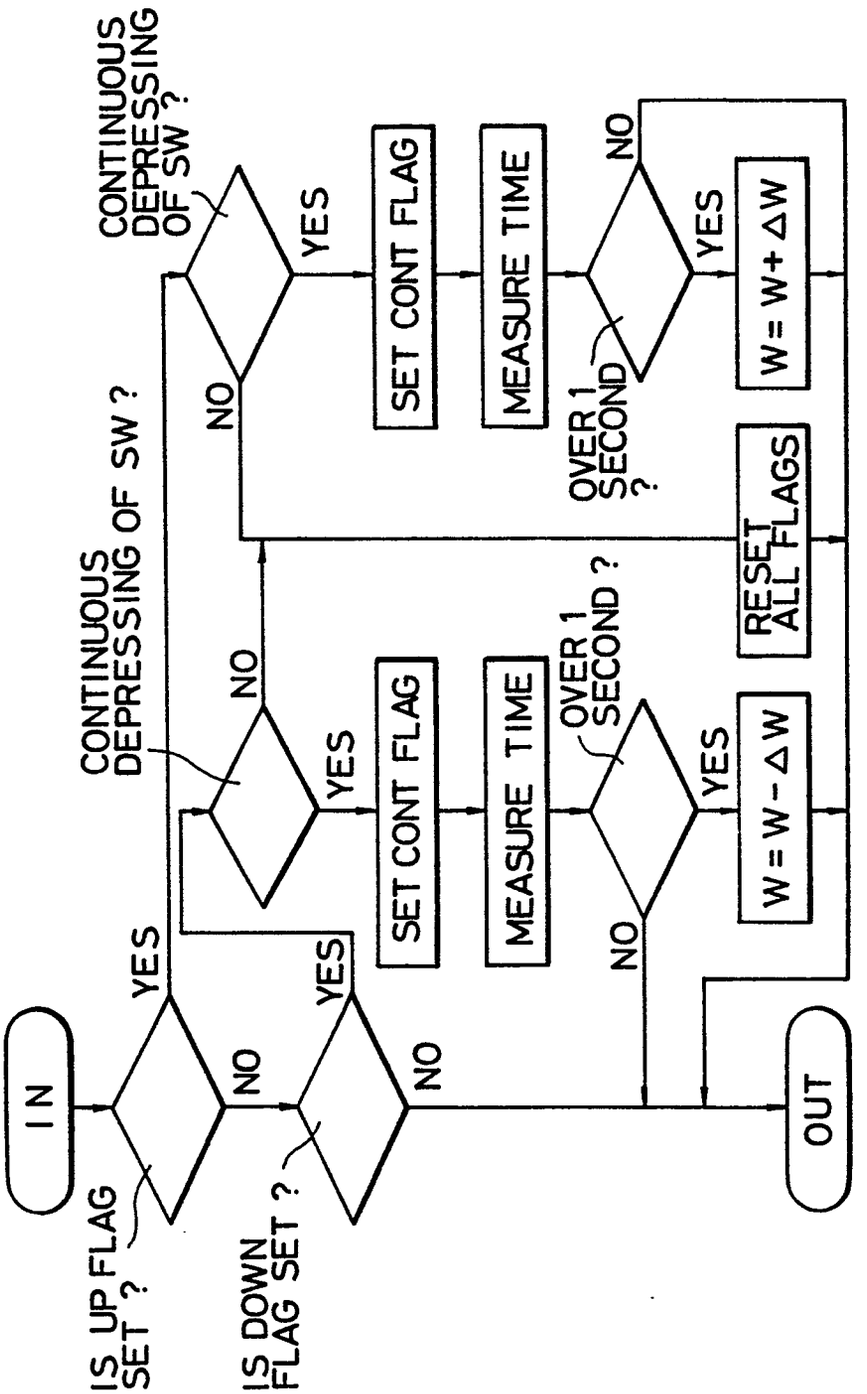

IN
IS UP FLAG SET ?
YES
NO
IS DOWN FLAG SET ?
YES
NO
CONTINUOUS DEPRESSING OF SW ?
YES
NO
SET CONT FLAG
MEASURE TIME
OVER 1 SECOND ?
YES
NO
W = W - ΔW
CONTINUOUS DEPRESSING OF SW ?
YES
NO
SET CONT FLAG
MEASURE TIME
OVER 1 SECOND ?
YES
NO
W = W + ΔW
RESET ALL FLAGS
OUT

FIG. 9

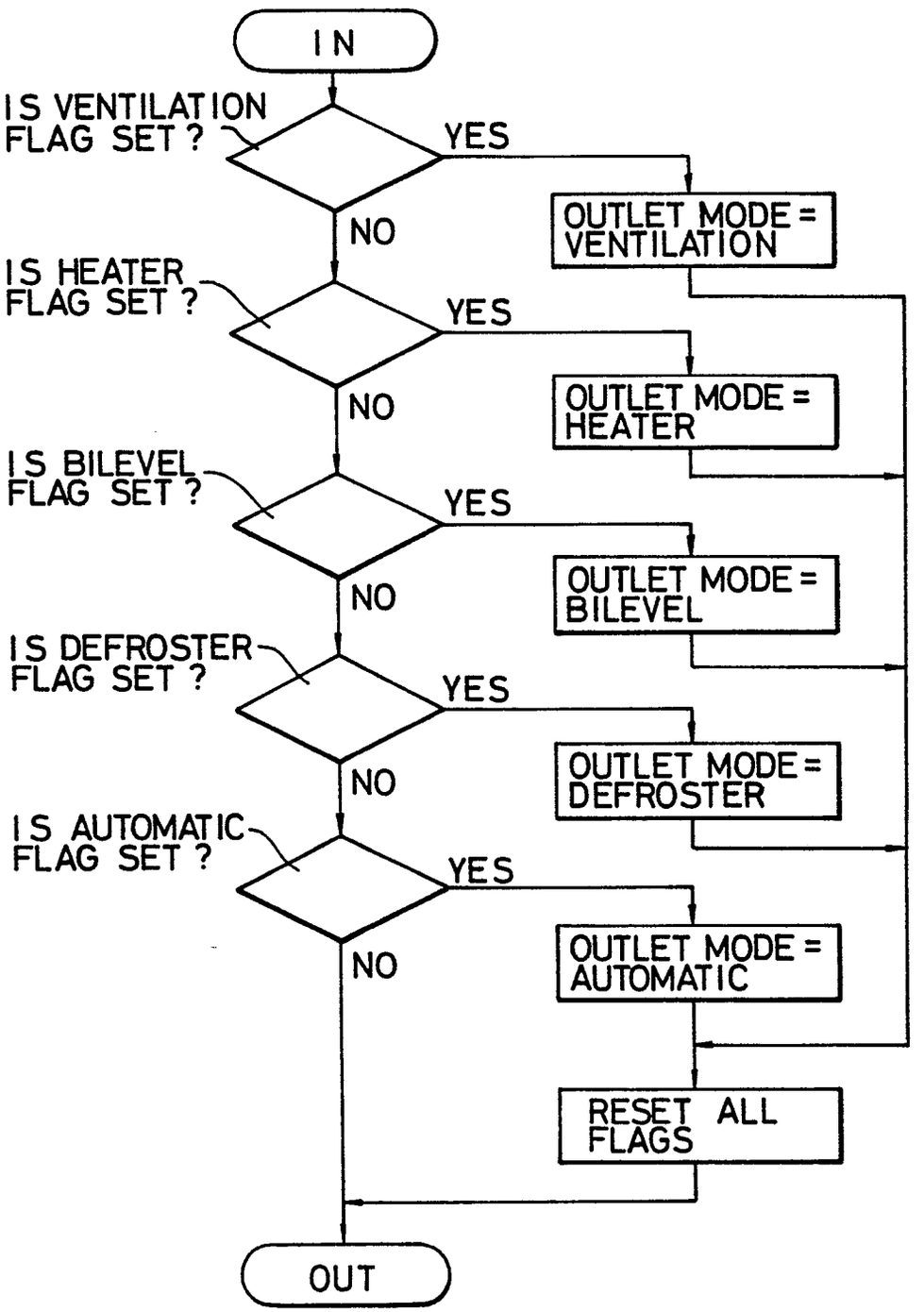
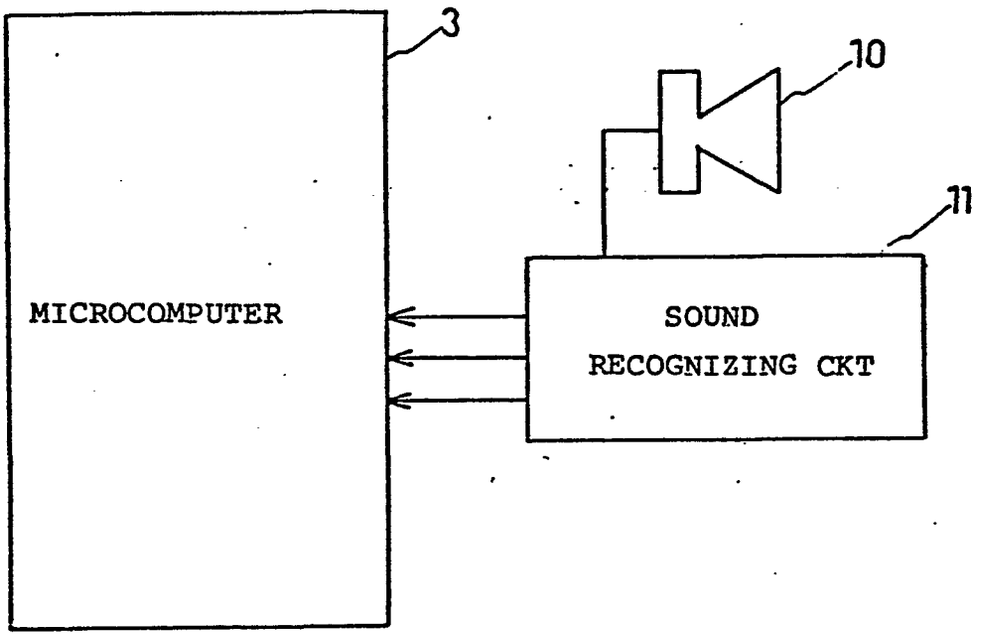

IN
IS VENTILATION FLAG SET ?
YES
NO
OUTLET MODE = VENTILATION
IS HEATER FLAG SET ?
YES
NO
OUTLET MODE = HEATER
IS BILEVEL FLAG SET ?
YES
NO
OUTLET MODE = BILEVEL
IS DEFROSTER FLAG SET ?
YES
NO
OUTLET MODE = DEFROSTER
IS AUTOMATIC FLAG SET ?
YES
NO
OUTLET MODE = AUTOMATIC
RESET ALL FLAGS
OUT

FIG. 10



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European Patent Office

Application number

EP 82 10 1739

EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	US-A-4 060 848 (HYATT) * abstract; column 3, lines 25 to 28; column 4, lines 35 to 50; column 6, lines 7 to 65; column 7, lines 10 to 43; column 11, lines 18 to 20; column 22, line 3 to column 23, line 30; column 31, line 38 to column 32, line 3; figures 1A,1B *	1-4,9, 10	B 60 R 16/02 B 60 H 1/00 H 03 J 1/02 H 03 G 1/02 // G 06 F 1/00 G 10 L 1/00
A	FUNKSCHAU, vol.50, no.14, June 30, 1978, Munchen (DE) D.K. LONG: "Management von Mikroprozessor-Schnittstellen in der Kraftfahrzeug-Elektronik; 1.Teil" pages 663 to 666		
A	FUNKSCHAU, vol.50, no.15, July 14, 1978, Munchen (DE) D.K. LONG: "Management von Mikroprozessor-Schnittstellen in der Kraftfahrzeug-Elektronik; 2. Teil", pages 719 to 721		
A	ELECTRONICA TOP INTERNATIONAAL, vol.4, no.6, June 1979, Bilthoven (NL) "Auto electronica", pages 10 to 14		
A	FR-A-2 445 769 (RENAULT)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

B 60 R 16/02
B 60 S 1/08
B 60 S 1/48
B 60 S 1/54
B 60 S 1/56
B 60 S 1/58
B 60 S 1/60
B 60 R 1/06
B 60 H 1/00
B 60 J 7/18
E 05 F 15/16
E 05 F 15/08
H 03 J 1/02
H 03 J 9/04
H 03 G 1/02

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24-06-1982	VERLEYE J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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European Patent Office

EUROPEAN SEARCH REPORT

0059952
Application number

EP 82 10 1739

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	FR-A-2 453 443 (HITACHI)		
A	FR-A-2 437 312 (RENAULT)		
A	GB-A-2 026 723 (TEKRON)		
A	EP-A-0 002 435 (LOEWE-OPTA)		
P,X	EP-A-0 034 373 (NIPPON DENSO) * page 1, line 18 to page 3, line 24; page 7, lines 9 to 16; page 10, line 24 to page 23, line 5; page 25, line 15 to page 27, line 10; figures 1,6,9 *	1-6,8-10	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

The present search report has been drawn up for all claims

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THE HAGUE	24-06-1982	VERLEYE J.

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